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TWO GROWTHS OF CHLAMYDOMONAS IN CONNECTICUT

BY FREDERICK S. HOLLIS

Growths of *Chlamydomonas* in water-supplies, although comparatively infrequent, have in several instances been studied and the presence of an unpleasant odor in the water proven to be associated with the growths.[1] The object of the present paper is mainly to record the presence of two recent growths in Connecticut in water of rather different character.

The first growth was observed in Walker's Pond at Burnside on September 11, 1900, when a sample received contained *Chlamydomonas* to the extent of 14,476 individuals or 5,790 standard units per c.c., while all other forms present amounted to only 886 standard units per c.c. On October 4, 1,354 individuals or 542 standard units were still present, while of other forms there were 293 standard units per c.c. The water was very turbid and had the marked, unpleasant odor due to *Chlamydomonas.*

Walker's Pond receives the water of the Hockanum River about two miles above its junction with the Connecticut. Hockanum River has its source in the overflow of Shenipsit Lake, the water-supply of Rockville, a source which at times supports considerable growths, as, for example, one of about 1,000 standard units per c.c. of *Synura* during the present winter. During its course of sixteen or eighteen miles the river receives considerable contamination, both of manufacturing waste and sewage. Filter beds have recently been put in operation for the removal of the South Manchester sewage, but were not in practical operation for any considerable time during the period when samples were taken. Averages of chemical analyses for 1900 and two previous years, together with the individual monthly analyses during 1900, when the growth was observed,[2] are as follows:

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[1] "Chlamydomonas in Spot Pond." F. S. Hollis and H. N. Parker. *Jour. N. E. W. W. Assn.,* Vol. XIV, No. 1. "Chlamydomonas and its Effect on Water Supplies." G. C. Whipple. *Trans. Am. Mic. Soc.,* Vol. XXI.

[2] Rept. Conn. St. Bd. of Health, 1900, p. 334.

CHEMICAL ANALYSIS, WALKER'S POND, BURNSIDE
PARTS PER MILLION

Date	Turbidity	Sediment	Odor	Color. Filt.	Residue on Evaporation						Chlorine	Nitrogen				
					Total at 100° C.		Non-vol. Mineral		Volatile Organic			Of Free Am. Unfilt.	Total Organic		Of Nitrites	Of Nitrates
					Filt.	Unfilt.	Filt.	Unfilt.	Filt.	Unfilt.			Filt.	Unfilt.		
1895.				.4	87.3	98.6	71.0	79.1	16.3	19.5	6.03	.172	.607	.802	.025	.10
1896.				.4	79.3	81.4	60.5	60.3	18.8	21.1	5.61	.194	.589	1.156	.023	.14
1900.				.4	73.7	80.7	56.6	61.1	17.1	19.6	4.65	.183	.628	.722	.025	.16
May 28, '00.	Slight.	Small (brown).	Mouldy.	.4	65.5	67.5	52.5	52.5	13.0	15.0	2.70	.180	.900	.950	.016	.15
June 12.	Very slight.	Scanty (brown).	None.	.4	66.0	70.0	51.0	54.0	15.0	16.0	3.70	.198	.620	.740	.016	.20
July 6.	Clear.	Small (brown).	Swampy.	.4	69.0	70.5	53.0	53.5	16.0	17.0	5.30	.180	1.100	1.200	.024	.05
Aug. 15.	Distinct.	Moderate (red).	Mouldy and unpleasant.	.5	61.0		45.0		16.5		5.10	.294	.320	.380	.036	.24
Sept. 11.	Very marked (green).	Small.	Marked unpleasant. Chlamydomonas.	.3	84.5	93.5	63.0	67.5	21.5	26.0	5.30	.052	.220	.360	.016	.12
Oct. 4.	Marked (organisms).	Moderate, flocculent, organisms.	Mouldy and oily. Chlamydomonas.	.4	95.5	102.0	75.0	78.0	20.5	24.0	5.80	.192	.610	.700	.040	.19

CHEMICAL ANALYSIS OF WATER FROM CRYSTAL LAKE RESERVOIR, WINSTED
PARTS PER MILLON

Date	Turbidity	Sediment	Odor	Color	Residue on Evaporation			Chlorine	Nitrogen of				Oxygen Consumed	Hardness	Alkalinity
					Total at 110° C.	Non-vol. Mineral	Volatile Organic		Free Am. Unfilt.	Album. Am. Unfilt.	Nitrites	Nitrates			
May 29, '02	Distinct green from organisms.		Distinctly unpleasant. Chlamydomonas.	Unfilt. .38 Filt. .36	41.0	19.0	22.0	1.36	.004	.186	.002	.09	6.7	8.0	7.0

The second occurrence was in the water-supply of Winsted. It was present in the tap water during the last six months of 1901, reaching a maximum of 232 individuals per c.c. in the middle of November; and the water during this growth had, in addition to the usual mouldy or vegetable odor, an unpleasant odor due to the *Chlamydomonas,* which was most marked when the numbers were greatest, in November. The growth during 1901 did not, I believe, cause complaint on the part of the consumers, but on May 29, 1902, samples were sent from the Crystal Lake Reservoir and from a tap supplied with water from this source, to ascertain the cause of a disagreeable odor that had been marked for three or four weeks. The odor of the water was the sharp, unpleasant, and slightly oily, odor, similar to an odor of putrefaction, which is characteristic of large numbers of *Chlamydomonas.* The microscopical examination showed that the organisms were in a well-advanced stage of growth, but perfectly fresh. *Chlamydomonas* was present to the extent of 970 individual or 242 standard units per c.c., sufficient to give a considerable turbidity and a greenish tinge to the water. Other forms amounted to 492 standard units per c.c.

Crystal Lake Reservoir is a natural lake situated 250 feet above Winsted, the elevation of which was increased 10 feet about 1895, and the new level maintained by conducting the water of two brooks into it through a tunnel, about a half mile long, cut through the rock of the hills. It has an area of 137 acres and available capacity of 390,000,000 gallons.

The *Chlamydomonas* present in Walker's Pond were about 17½ μ long and 14 μ broad, corresponding to .4 of a standard unit. Those in Crystal Lake Reservoir were somewhat smaller, being 14.3 μ long and 11 μ broad, corresponding to .25 of a standard unit. Each growth contained some individuals much smaller than this average, but the great majority were uniform in size. Among those in Walker's Pond were a few of the flask-shaped forms described by Mr. Whipple in the Brooklyn supply. Those of each growth had a cleft or divided chromatophore inclosed in a lorica; but the portions of the chromatophore were smaller and more widely separated in the Winsted growth. The contractile vacuole, oil globules, and starch grains were well marked in those from each locality. The red eye-spots were far more abundant in the Winsted specimens.

The flagella of the forms from Winsted were studied with care, especially with high illumination. While swimming, the form appeared to have one flagellum, or possibly two, projecting forward about twice the length of the body. These were slightly curved toward the extremity and had but little motion. Several were seen in which there appeared to be two of these flagella starting from the lorica but which were brought closely together about a quarter of their length forward and appeared beyond this point as one. On coming to rest, these flagella remained stationary and two other flagella were brought forward, which, during motion, were curved backwards and were in such rapid motion as generally to escape detection. The forms generally rose in the cell during the examination and rested against the under side of the cover-glass. On touching the cover-glass lightly, the forms at rest with the swimming flagella projecting forward along with those not used in swimming, quickly curved the swimming flagella back more closely along the lorica than in the position while swimming. The straighter flagella, not used in swimming, are not drawn back unless the cover-glass is tapped harder and, even then, never as completely as the apparently more flexible swimming flagella.

Associated with each growth were moderate numbers of other infusoria, considerable numbers of diatoms, and some rotifers. In the case of the larger rotifers, it was evident that they had been preying upon the *Chlamydomonas*.

In filtering the foregoing samples use was made of a column of sand of the usual depth which passed through a 60-mesh sieve but was retained by a 120-mesh. The filtrate was found by the use of a centrifuge to contain *Chlamydomonas* in numbers which, by comparison with an unfiltered sample, were estimated to amount to nearly twenty per cent of the total number. The numbers given are corrected on this basis.